UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/621,872	07/16/2003	Ming-Hsuan Yang	23085-07128	1743

758 7590 09/13/2007

FENWICK & WEST LLP
SILICON VALLEY CENTER
801 CALIFORNIA STREET
MOUNTAIN VIEW, CA 94041

EXAMINER	
YUAN, KATHLEEN S	

ART UNIT	PAPER NUMBER
2624	

MAIL DATE	DELIVERY MODE
09/13/2007	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)
	10/621,872	YANG, MING-HSUAN
	Examiner	Art Unit
	Kathleen S. Yuan	2624

-- *The MAILING DATE of this communication appears on the cover sheet with the correspondence address* --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *19 July 2007*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-43* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1,6-10,15-21,26-30,35-43* is/are rejected.

7)☒ Claim(s) *2-5,11-14,22-25,31-34* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

The response received on 7/19/2007 has been placed in the file and was considered by the examiner. An action on the merit follows.

Response to Amendment/Arguments

1. The amendments/ arguments filed on 19 July 2007 have been fully considered. Response to these amendments/ arguments is provided below.

<u>*Summary of Amendments/ Arguments and Examiner's Response:*</u>

2. The applicant has amended in the word "and" in many of the claims.

3. *The applicant argues that in Roweis, the weights do not represent an estimate of the geodesic distance between Xi and its neighbors and that the weights are the solution to a least squares problem.*

4. As disclosed in the previous office action, the examiner does not disclose that the weights are an estimate of the geodesic distances and its neighbors. The examiner stated that distances are measured to a point so that a weight can be calculated. The weight depends on the distances of each neighboring point to Xi. The weight, although is not a direct "distance" measurement, is a representation of the distance and was mentioned in the previous office action to illustrate this fact. Furthermore, on page 2323, col. 3, lines 23-24, the word "distances" is referred to in order to calculated reconstruction errors. Therefore, in order to input distances, they must be calculated/ measured. Therefore, Roweis does disclose an estimate of the geodesic distance.

5. *The applicant further argues that "Roweis teaches away from a feature vector corresponding to the geodesic distances to other data points by disclosing the LLE method 'eliminates the need to estimate pairwise distances between widely separated data points'" on page 18, lines 5-7.*

6. This statement does not teach away. Roweis discloses that the LLE method "eliminates the need to estimate pairwise distances between **widely separated** data points.' This statement illustrates that Roweis only needs to estimate pairwise distances between data points that are close together. Therefore, distances are still being measured, in fact, distances based on the neighboring graph, the graph that shows which points are close neighbors, as disclosed in the previous office action and shown in fig. 2, and Roweis does not teach away.

7. *Furthermore, the applicant argues that "Liu does not disclose or suggest applying FLD to a feature vector corresponding to geodesic distances to neighboring data points. Rather, Liu describes FLD as applied to a vector that is composed of a set of image classes rather than estimates of geodesic distances (Liu, Section 2.2, paragraph 1). Accordingly, the classification method in Liu teaches away from using local neighborhood information contained in the feature vectors as recited in the claimed invention. Thus, independent claims 1 and 21 are patentable over Roweis and Liu."*

8. When Liu applies a vector to a set of image classes, image classes are those that are associated because they are all in the same "area" so to speak and are very close to each other. Thus, they are neighbors. This corresponds to the neighbors of Roweis. Although Roweis may use a different way of calculating the neighbors, both

references are finding data points that are neighbors. It would have been obvious to one of ordinary skill in the art to apply FLD to neighbors associated with the process of Roweis, since FLD is applied to the neighbors of Liu. Therefore, Liu does not teach away, but supports and makes obvious the "extra step" not expressly disclosed in Roweis et al. The extra step is further supported by Roweis, since Roweis discloses applying its method on other traditional methods such as PCA and MDS (page 2325, col. 3, paragraph 3). It is noted that it is well known that another traditional method is LDA, often associated with PCA but not expressly disclosed in Roweis. Therefore, the addition of Liu as a reference was provided.

9. *"Similarly, although Mika discloses a KFLD technique, Mika fails to disclose or suggest applying KFLD to a feature vector corresponding to geodesic distances to neighboring data points."*

10. Similarly, Liu and Mika do disclose and suggest applying KFLD to a feature vector, as disclosed above and in the previous office action, to those neighboring data points. Roweis discloses that the neighboring data points have a geodesic distance associated.

11. All rejections are maintained.

Claim Rejections - 35 USC § 103

12. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the

invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

13. Claims 1, 6-9, 21, 26-29, 40 and 42 are rejected under 35 U.S.C. 103(a) as being unpatentable over "Nonlinear Dimensionality Reduction by Locally Linear Embedding" (Roweis et al) in view of "Evolutionary Pursuit and Its Application to Face Recognition" (Liu et al).

Regarding claim 21, Roweis et al discloses a system for representing a set of images for pattern classification, the system comprising: neighboring graph generation module, the module that carries out the steps of fig. 2, (1), for receiving data points corresponding to the set of images in an input space, the data points being all the points in the input space as seen in fig. 2, (1), and for generating a neighboring graph indicating whether the data points are neighbors, the neighboring graph being the black points that are selected in fig. 2, (1); a geodesic distance estimation module, the module that would carry out the steps of fig. 2, (2), for estimating geodesic distances between the data points based upon the neighboring graph, in which the distances are measured to a selected point X_i, so that a weight can be calculated, W_{ik}, to help reconstruct the point with the neighbors. Furthermore, Roweis et al discloses that the each of the data points are represented by an associated feature vector corresponding to the geodesic distances to other data points, the associated vector being the vector from the origin to each of the reduced dimensionality points in fig. 2, (3), and which correspond to the geodesic distance because the reduced dimensionality data points are determined by the weights which in turn is determined by distances.

Roweis et al does not disclose expressly that a Fisher Linear Discriminant module represents each of the data points by the associated feature vector and for applying Fisher Linear Discriminant to the feature vectors associated with the data points to obtain an optimal direction for projecting the feature vectors for pattern classification.

Liu et al discloses that a Fisher Linear Discriminant is used to represent each of the data points by an associated feature vector, the vector being the vector from the origin to the data point, each of the data points represented by classes $\omega_1,\ldots\omega_L$, in which many number of images are classified, represented by $N_1,\ldots N_L$, each of the images being the each of the data points (pg. 572, paragraph 3). Furthermore, The Fisher Linear Discriminant is applied to the feature vectors associated with the data points to obtain an optimal direction for projecting the feature vectors for pattern classification by deriving the projection matrix that will maximize Ψ (pg. 572, pp. 4)

Roweis et al and Liu et al are combinable because they are from the same field of endeavor, i.e. pattern classification in feature spaces and reducing information/ dimensionality.

At the time of the invention, it would have been obvious to a person of ordinary skill in the art to use a Fisher Linear Discriminant to find the projection direction.

The suggestion/motivation for doing so would have been to allow for the most accurate way to represent classes for recognition since the FLD distinguishes effectively between the between and within scatters.

Therefore, it would have been obvious to combine the dimensionality reduction system of Roweis et al with the Fisher Linear Discriminant of Liu et al to obtain the invention as specified in claim 21.

14. Claims 1, 40 and 42 are rejected for the same reasons as claim 21. Thus, the arguments analogous to that presented above for claim 21 are equally applicable to claims 1, 40 and 42. Claim 21 distinguishes from claims 1, 40 and 42 only in that claim 21 is a system claim in the preamble and claims 1, 40 and 42 are method, computer program product stored on a computer readable medium, and a broader systems claim, respectively. A system carries out a method, and furthermore, the preamble to the claim is not given any patentable weight because it doesn't breath life or vitality into the claim; therefore, prior art applies.

15. Regarding claim 26, Roweis et al discloses projecting the feature vectors to a lower dimensional space lower in dimension than the input space, since in fig. 2, (2) the vectors are in 3D and in fig. 2 (3), the space is in 2D, thus lower in dimension. Liu et al discloses the Fisher Linear Discriminant module applies Fisher Linear Discriminant to the feature vectors that were projecting the feature vectors to a lower dimensional space lower in dimension than the input space by Roweis et al so as to substantially maximize a variance between clusters of feature vectors while substantially minimizing the variance within each cluster of the feature vectors, since Roweis et al maximizes the projection matrix Ψ, which is the variance between clusters divided the variance within clusters (pg. 572, pp. 3 and 4), thus inherently maximizing the between clusters and minimizing the variance within each cluster.

16. Regarding claim 27, Liu et al discloses the variance between the clusters of the feature vectors is represented by a between-class scatter matrix, Σ_w, and the variance within each cluster of the feature vectors is represented by a within-class scatter matrix Σ_b, (pg. 572, paragraph 3 and eq. 4 and 5).

17. Regarding claim 28, Liu et al and Roweis et al disclose that the feature vectors are projected to the lower dimensional space so as to substantially maximize a ratio of the between-class scatter matrix to the within-class scatter matrix, as explained above in the rejection for claim 26 and on pg. 572, pp. 4 of Liu et al.

18. Regarding claim 29, Liu et al discloses that FLD is applied to face images for face recognition (pg. 570, title).

19. Claims 6, 7, 8 and 9 are rejected for the same reasons as claims 26, 27, 28 and 29, respectively. Thus, the arguments analogous to that presented above for claims 6, 7, 8 and 9 are equally applicable to claims 26, 27, 28 and 29. Claims 6-9 distinguish from claims 27-29 only in that they have different dependencies, all of which have been previously rejected. Therefore, prior art applies.

20. Claims 10, 14-20, 30, 34-39, 41 and 43 are rejected under 35 U.S.C. 103(a) as being unpatentable over Roweis et al in view of Liu et al, as applied to claim 21 above, and further in view of "A Mathematical Programming Approach to Kernel Fisher Algorithm" (Mika et al).

Regarding claim 30, Roweis et al (as modified by Liu et al) discloses all of the claimed elements as set forth above and incorporated herein by reference.

Claim 30 is rejected for the same reasons as claim 21. Thus, the arguments analogous to that presented above for claim 21 are equally applicable to claim 30. Claim 21 distinguishes from claim 30 only in that claim 30 uses Kernel Fisher Discriminant instead of simply the Fisher Discriminant. Mika et al teaches further this feature, i.e. the use of Kernel Fisher Discriminant (title).

Roweis et al (as modified by Liu et al) and Mika et al are combinable because they are from the same field of endeavor, i.e. Fisher Discriminant Analysis.

At the time of the invention, it would have been obvious to a person of ordinary skill in the art to use a Kernel Fisher Discriminant.

The suggestion/motivation for doing so would have been to provide a more flexible system by allowing the system to operate in a kernel feature space, thereby yielding a nonlinear discriminant.

Therefore, it would have been obvious to combine the system of Roweis et al (as modified by Liu et al) with the Kernel Fisher Discriminant of Mika et al to obtain the invention as specified in claim 30.

21. Claims 10, 41 and 43 are rejected for the same reasons as claim 30. Thus, the arguments analogous to that presented above for claim 30 are equally applicable to claims 10, 41 and 43. Claim 30 distinguishes from claims 10, 41 and 43 only in that claim 30 is a system claim in the preamble and claims 10, 41 and 43 are method, computer program product stored on a computer readable medium, and a broader systems claim, respectively. A system carries out a method, and furthermore, the

preamble to the claim is not given any patentable weight because it doesn't breath life or vitality into the claim; therefore, prior art applies.

22. Regarding claim 35, Roweis discloses that Fisher Linear Discriminant analysis maximizes the projection matrix Ψ, which is the variance between clusters divided the variance within clusters (pg. 572, pp. 3 and 4), thus inherently maximizing the between clusters and minimizing the variance within each cluster. Mika et al discloses the Kernel Fisher Linear Discriminant module applies Kernel Fisher Linear Discriminant to the feature vectors by: projecting the feature vectors to a high dimensional feature space using a projection function, the projection function being $k(x_i,x_j)$ (pg. 2, paragraph 3), a Mercer Kernel function (pg. 1, paragraph 2); generating Kernel "Fisherfaces" of the feature vectors projected to the high dimensional feature space, the feature vectors being that vector made by a test point; projecting the feature vectors to a lower dimensional space lower in dimension than the input space and the high dimensional feature space based on the Kernel "Fisherfaces" by projection of the test point onto the discriminant. Mika does not call the Kernel "Fisherfaces" distinctly fisherfaces, however, Liu et al discloses that FLD is applied to face images for face recognition (pg. 570, title), thus indicating the use of faces.

23. Claims 36-37 are rejected for the same reasons as claims 7-8. Thus, the arguments analogous to that presented above for claims 7-8 are equally applicable to claims 36-37. Claims 36-37 distinguishes from claims 7-8 only in that they have different dependencies, all of which have been previously rejected. Therefore, prior art applies.

24. Regarding claim 39, Mika et al discloses that the projection function Φ (x) satisfies the following relation :$k(x, y) = \Phi(x) \cdot \Phi(y)$ where $k(x, y)$ is a kernel function, or $k(x_i,x_j) = \Phi(x_i) \cdot \Phi(x_j)$, where $x= x_i$ and $y = x_j$ (pg. 2, paragraph 3).

25. Claims 15-17, 19 are rejected for the same reasons as claims 35-37, 39, respectively. Thus, the arguments analogous to that presented above for claims 35-37, 39 are equally applicable to claims 15-17, 19. Claims 15-17, 19 distinguish from claims 35-37, 39 only in that they have different dependencies, all of which have been previously rejected. Therefore, prior art applies.

26. Regarding claim 18, Mika et al discloses that the identity matrix is added to the kernel matrix (pg. 2, paragraph 3), thus adding a fraction of the identity matrix to the within-class scatter matrix (equation 4).

27. Regarding claim 38, Liu et al discloses that FLD is applied to face images for face recognition (pg. 570, title).

28. Claim 20 is rejected for the same reasons as claim 38. Thus, the arguments analogous to that presented above for claim 38 are equally applicable to claim 20. Claim 20 distinguishes from claim 38 only in that they have different dependencies, all of which have been previously rejected. Therefore, prior art applies.

Allowable Subject Matter

29. Claims 2-5, 11-14, 22-25 and 31-34 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

30. Regarding claims 5, 14, 25 and 34, contains allowable subject of finding the geodesic distance between the data points by finding the distance with short hops according to the Floyd-Warshall algorithm. Roweis simply finds neighbors by directly finding the distance instead.

31. Claims 2-4, 11-13, 22-24 and 31-33 contain allowable subject matter. Although LLE does all the steps excluding assigning an infinite value for the neighboring graph responsive to determining that the data points are not neighbors.

Conclusion

32. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of

the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Kathleen S. Yuan whose telephone number is (571)272-2902. The examiner can normally be reached on Monday to Thursdays, 9 AM to 5 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Bhavesh Mehta can be reached on (571)272-7453. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

KY
9/4/2007

BHAVESH M MEHTA
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2600